

ENVIRONMENTAL NOISE ANALYSIS

WHISPER CREEK UNIT I

Placer County, California

BBA Project No. 04-224A

Prepared For

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INTRODUCTION

The proposed Whisper Creek Unit 1 Subdivision Project is located south of and adjacent to PFE Road, west of Cook-Riolo Road and east of Walerga Road in Western Placer County. The proposed subdivision consists of 104 single-family residential lots. Future traffic on PFE Road is considered to be a potentially significant noise source at this location, and the developer has requested an acoustical analysis to determine whether traffic could cause noise levels at the project site to exceed acceptable limits. Specifically, the developer has requested that an analysis be prepared to show compliance with the criteria of the Noise Element of the Placer County General Plan.

CRITERIA

The Noise Element of the Placer County General Plan establishes an exterior noise level standard of 60 dB L_{dn} ¹ (or CNEL) at the outdoor activity areas of new residential uses affected by roadway noise. An exterior noise level of up to 65 dB L_{dn} is considered to be Conditionally Acceptable, and may be allowed only after a detailed acoustical analysis is performed and needed noise abatement features are included in the design. Typically, the outdoor activity areas for residential developments are considered to be the back yard patios or decks of single-family dwellings. Where the location of the outdoor activity area is not known, the exterior noise level standard is applied at the property line of the receiving land use. The Noise Element also establishes an interior noise level standard of 45 dB L_{dn} for residential uses.

Guidance for assessing the significance of changes of traffic noise levels is provided by the 1992 findings of the Federal Interagency Committee on Noise (FICON), which assessed the annoyance effects of changes in ambient noise levels resulting from aircraft operations. The FICON recommendations are based upon studies that relate aircraft and traffic noise levels to the percentage of persons highly annoyed by the noise. Annoyance is a summary measure of the general adverse reaction of people to noise that generates speech interference; sleep disturbance, or interference with the desire for a tranquil environment.

The rationale for the FICON recommendations is that it is possible to consistently describe the annoyance of people exposed to transportation noise in terms of L_{dn} . The changes in noise exposure that are shown in Table I are expected to result in equal changes in annoyance due to noise. Although the FICON recommendations were specifically developed to address aircraft noise impacts, they are used in this analysis for traffic noise described in terms of L_{dn} .

¹For an explanation of terms used in this report, see Appendix A.

TABLE I SUBSTANTIAL INCREASES FOR TRANSPORTATION NOISE EXPOSURE	
Ambient Noise Level Without Project (L_{dn})	Significant Impact Assumed to Occur if the Project Increases Ambient Noise Levels By:
<60 dB	+ 5 dB or more
60-65 dB	+3 dB or more
>65 dB	+2 dB or more
Source: FICON as applied by Brown-Buntin Associates, Inc.	

EVALUATION OF EXISTING AND FUTURE NOISE ENVIRONMENTS

Brown-Buntin Associates, Inc. (BBA) employs the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA RD-77-108) for the prediction of traffic noise levels. The FHWA model is the analytical method currently favored for traffic noise prediction by most state and local agencies, including the California Department of Transportation (Caltrans). The model is based upon the CALVENO noise emission factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site.

The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is considered to be accurate within ± 1.5 dB. To predict L_{dn} values, it is necessary to determine the day/night distribution of traffic and to adjust the traffic volume input data to yield an equivalent hourly traffic volume.

Traffic Noise Level Measurements:

Sound level measurements and concurrent traffic counts were conducted adjacent to PFE Road, 30 feet from the roadway centerline on July 2, 2004 (see Figure 1). The measurements were conducted at a height of 5 feet above the ground to represent ground-level receivers, and 15 feet above the ground to represent second story receivers. The purpose of the noise measurements was to determine the accuracy of the FHWA traffic noise prediction model in describing traffic noise levels in the vicinity of the project site.

Sound measurement equipment consisted of Larson Davis Model 820 precision sound level meters. The measurement equipment was calibrated in the field immediately before use with a Larson Davis Model CA-250 acoustical calibrator, and meets the specifications of the American National Standards Institute (ANSI) for Type 1 sound measurement systems.

The noise measurements were conducted in terms of the average noise level (L_{eq}), and the measured values were later compared to the value predicted by the FHWA model using observed

traffic volumes, truck mix, speeds, roadway geometries and distance to the microphone. Table II compares the measured and modeled noise levels for the observed traffic conditions.

TABLE II NOISE MEASUREMENT SUMMARY AND FHWA MODEL CALIBRATION Whisper Creek Unit 1, Placer County, California								
Roadway	Distance, Feet	Mic Height, Feet	Posted Speed, mph	Observed Vehicles/Hour			L _{eq} , dB	
				Autos	Med. Trucks	Hvy. Trucks	Measured	Predicted by FHWA Model*
PFE Road	30	5	45	312	20	4	66.5	66.7
PFE Road	30	15	45	312	20	4	65.8	66.7
* Assumes acoustically “soft” site								

The FHWA model over-predicted the PFE Road traffic noise levels by 0.2 dB at a height of five feet, and over-predicted the noise level by 0.9 dB at the fifteen-foot height. The five-foot height is representative of the first floor receiver, and the fifteen-foot height represents a second floor receiver. Given the FHWA model’s reasonable agreement with the measured noise level at the ground receiver’s height, no offset was applied to predict future exterior noise levels.

Continuous noise measurements were made over a 24-hour period at 9450 Duffy Lane adjacent to PFE Road on August 4-5, 2004. Those measurements indicated an 87%/13% day/night distribution of roadway noise levels. The measured L_{dn} at a distance of approximately 60 feet from the PFE Road centerline was 65.3 dB L_{dn}. Figure 2 shows the measured hourly noise levels for the continuous noise measurements.

Traffic Noise Prediction Model Inputs:

BBA conducted traffic noise level analyses for the future year scenarios identified in Table III using the FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108X). Inputs to the FHWA model include average daily traffic volume (ADT), daytime/nighttime traffic distribution, medium and heavy truck percentages, and vehicle speed. Existing and future Annual Average Daily Traffic (AADT) data were obtained from a traffic study produced for the project by KD Anderson, for the year 2025. BBA used existing file data to arrive at typical medium and heavy truck percentages for arterial roadways. The FHWA model inputs for future traffic volumes are shown in Table IV.

TABLE III PROJECT ALTERNATIVES WHISPER CREEK UNIT 1 Placer County, California	
Alternative	Conditions
1	Existing + Project (Whisper Creek 1)
2	Future No Project with PFE Road Open and Don Julio Blvd NOT Extended
3	Future + Project with PFE Road Open and Don Julio Blvd NOT Extended
4	Future No Project with PFE Road Closed and Don Julio Blvd Extended
5	Future + Project with PFE Road Closed and Don Julio Blvd Extended
6	Future No Project with PFE Road Open and Don Julio Extended
7	Future + Project with PFE Road Open and Don Julio Extended
8	Future No Project with PFE Road Closed and Don Julio NOT Extended
9	Future + Project with PFE Road Closed and Don Julio NOT Extended

TABLE IV FHWA HIGHWAY TRAFFIC NOISE PREDICTION MODEL INPUTS Whisper Creek Unit 1, Placer County, California						
Alternative *	Roadway	ADT	Day/Night %	% Medium Trucks	% Heavy Trucks	Speed (mph)
1	PFE	6,508	87/13	2.5	1.5	45
2	PFE	9,896	87/13	2.5	1.5	45
3	PFE	10,292	87/13	2.5	1.5	45
4	PFE	11,586	87/13	2.5	1.5	45
5	PFE	11,766	87/13	2.5	1.5	45
6	PFE	11,537	87/13	2.5	1.5	45
7	PFE	11,877	87/13	2.5	1.5	45
8	PFE	5,538	87/13	2.5	1.5	45
9	PFE	5,788	87/13	2.5	1.5	45
* See alternatives listed in Table III						

The FHWA model was used to predict traffic noise levels for each of the alternatives listed in Table III. The predicted exterior noise levels at a reference distance of 72 feet from the roadway centerline are shown in Table V. The reference distance represents a typical backyard receiver location.

TABLE V Predicted Future Traffic Noise Levels Whisper Creek Unit 1, Placer County, California					
Alternative	Roadway	L _{dn} , dB at 72 feet	Distance to L _{dn} Contour (feet)		
			60 dB	65 dB	
1	PFE	63.0	115	53	
2	PFE	64.9	152	70	
3	PFE	65.0	156	72	
4	PFE	65.5	168	78	
5	PFE	65.6	170	79	
6	PFE	65.5	168	78	
7	PFE	65.6	171	79	
8	PFE	62.3	103	48	
9	PFE	62.5	106	49	

Table V indicates that for all nine of the alternatives analyzed, the exterior noise level at a reference distance of 72 feet from the roadway centerline will exceed the Placer County 60 dB L_{dn} exterior noise level standard. Mitigation will be necessary to achieve the exterior noise level standard.

TABLE VI Difference in Predicted Traffic Noise Levels Relative to Future No Project Alternatives Whisper Creek Unit 1, Placer County, California					
Project Alternative	Roadway	Difference, dB			
		Alternative 2	Alternative 4	Alternative 6	Alternative 8
1	PFE	-1.9	-2.5	-2.5	0.7
3	PFE	0.1	-0.5	-0.5	2.7
5	PFE	0.7	0.1	0.1	3.3
7	PFE	0.7	0.1	0.1	3.3
9	PFE	-0.5	-3.0	-3.0	0.2
Note: Shaded cells indicate a significant impact					

Table VI shows the change in noise levels between the project alternatives (1, 3, 5, 7, and 9) compared to the four no project alternatives (2, 4, 6, and 8). Since existing traffic noise level at the reference distance (62.8 dB L_{dn}) is between 60 and 65 dB L_{dn}, an increase of +3 dB or more would be considered a significant increase (per Table I). Therefore, the increase of 3.3 dB for project alternatives 5 and 7 versus no project alternative 8 would be considered a significant impact. Project alternatives 1, 3, and 9 would result in a less than significant impact compared to all four no project alternatives.

ANALYSIS

Exterior Noise Levels:

Mitigation measures addressed by this analysis include the use of setbacks and noise barriers. To achieve the noise level standard of 60 dB L_{dn} , outdoor activity areas with line of sight to PFE Road would require setbacks between 103 feet to 171 feet from the centerline of the roadway, which would be infeasible.

For this project, a noise barrier would be more practical than setbacks. Pad elevations for lots adjacent to PFE Road vary in height from approximately 116 feet to 127 feet (lot 104). The PFE roadway elevation varies from approximately 120 feet to 130 feet along the project site. The difference between pad elevations and roadway elevations varies from being at grade, to as much as eight feet (roadway elevated). The project design includes an earthen berm located within an open space lot and an HOA easement. The barrier/roadway geometry for lots adjacent to PFE Road was derived from the street sections prepared by Baker Williams Engineering Group on November 4, 2005, as shown by Figures 3 and 4.

BBA conducted a noise barrier analysis for the project's lots adjacent to PFE Road using the worst-case predicted noise level of the nine alternatives analyzed above. The worst-case exterior noise level is 65.6 dB L_{dn} (Alternatives 5 and 7). Five scenarios for pad levels versus roadway elevation were analyzed: (1) at grade, (2) roadway 2 feet above, (3) roadway 3 feet above, (4) roadway 6 feet above, and (5) roadway 7 feet above. For each of these analyses it was assumed that the barrier would be located at the right-of-way (ROW) for each lot adjacent to PFE Road. It was also assumed that the outdoor receiver was 12 feet inside the ROW for the lots adjacent to PFE Road. Table VII shows the results of the Noise Barrier Analysis.

TABLE VII Noise Barrier Analysis Whisper Creek Unit 1, Placer County, California			
Pad Level vs Roadway Elevation	Lot Numbers	Required Height to meet 60 dB L_{dn} (Feet)	Required Height to Break Line of Sight (Feet)
Pad Level at Grade with Roadway	1-3, 31	5 ½	5 ½
Roadway 2 Feet Above Pad	32, 33	6	6
Roadway 3 Feet Above Pad	34, 35, 104	6	6
Roadway 6 Feet Above Pad	36, 37	6 ½	6 ½
Roadway 7 Feet Above Pad	38	8 ½	8 ½

In all cases, the minimum barrier height required to meet the 60 dB L_{dn} criterion is also the height required to break line of sight to the roadway. The developer's proposed 8-foot barrier will meet this requirement for all of the lots except Lot 38 where a minimum barrier height of 8-1/2 feet is necessary to both break line of sight, and to meet the 60 dB L_{dn} criterion.

The assumed noise barrier positioning is along the ROW adjacent to PFE Road. The barrier should wrap to the rear lot lines of lots 38, 3, and 104. For lots 1 and 31 the barrier should wrap to the building's rear facade.

Interior Noise Levels:

Modern energy-conserving residential building practices can be expected to provide a Noise Level Reduction (NLR) for traffic noise of 20 to 25 dB. If the exterior noise level is 65 dB L_{dn} or less, typical facade designs and construction in accordance with prevailing industry practices are expected to provide adequate noise attenuation to comply with the interior noise level standard of 45 dB L_{dn} . Since the noise levels for the lots adjacent to PFE Road will exceed 65 dB L_{dn} , noise levels inside the first-floor rooms of these lots are not expected to comply with the Placer County 45 dB L_{dn} interior noise level standard, unless the recommended noise barriers are installed.

However, the exterior noise level at the building façade for second floor receivers will normally be about 3 dB higher than that at the ground floor, and the barriers will not provide any shielding. The future noise levels at the second floor building facades for homes adjacent to PFE Road could be as high as 68.6 dB L_{dn} . Acoustical glazing may be required for the second floor of two-story homes to meet the 45 dB L_{dn} interior noise level standard. If two-story homes are placed adjacent to PFE Road a qualified acoustical consultant should review the building plans when they become available.

CONCLUSIONS:

The design of the Whisper Creek 1 project is expected to comply with the exterior and interior noise level requirements of the Noise Element of the Placer County General Plan, provided that the following measures are included in the project design:

1. Minimum barrier heights indicated by Table VII should be provided along PFE Road at the lot lines to reduce the traffic noise level to less than 60 dB L_{dn} . Noise barrier placement should be as depicted in Figure 1.
2. As building and final grading plans become available, the plans should be reviewed by a qualified acoustical consultant to ensure that both the Placer County exterior and interior noise level standards will be met.

These conclusions are based upon the best available laboratory and field test data for noise source characteristics and sound transmission of standard wall assemblies. Careful workmanship is required to ensure that the performance of the installed assemblies is consistent with the

testing results. Panel integrity should not be compromised by poorly sealed penetrations or by flanking paths.

It is the responsibility of the builder to ensure that all materials and construction practices employed for this project are consistent with the design assumptions used for this analysis. BBA is not responsible for substitutions, deletions, or defects in manufacture or workmanship.

Respectfully submitted,
Brown-Buntin Associates, Inc.

A handwritten signature in black ink, appearing to read "Gary Stowell". The signature is fluid and cursive, with the first name "Gary" being more prominent than the last name "Stowell".

Gary Stowell
Senior Consultant

Figure 1
Whisper Creek Unit 1
Noise Measurement and Barrier Locations

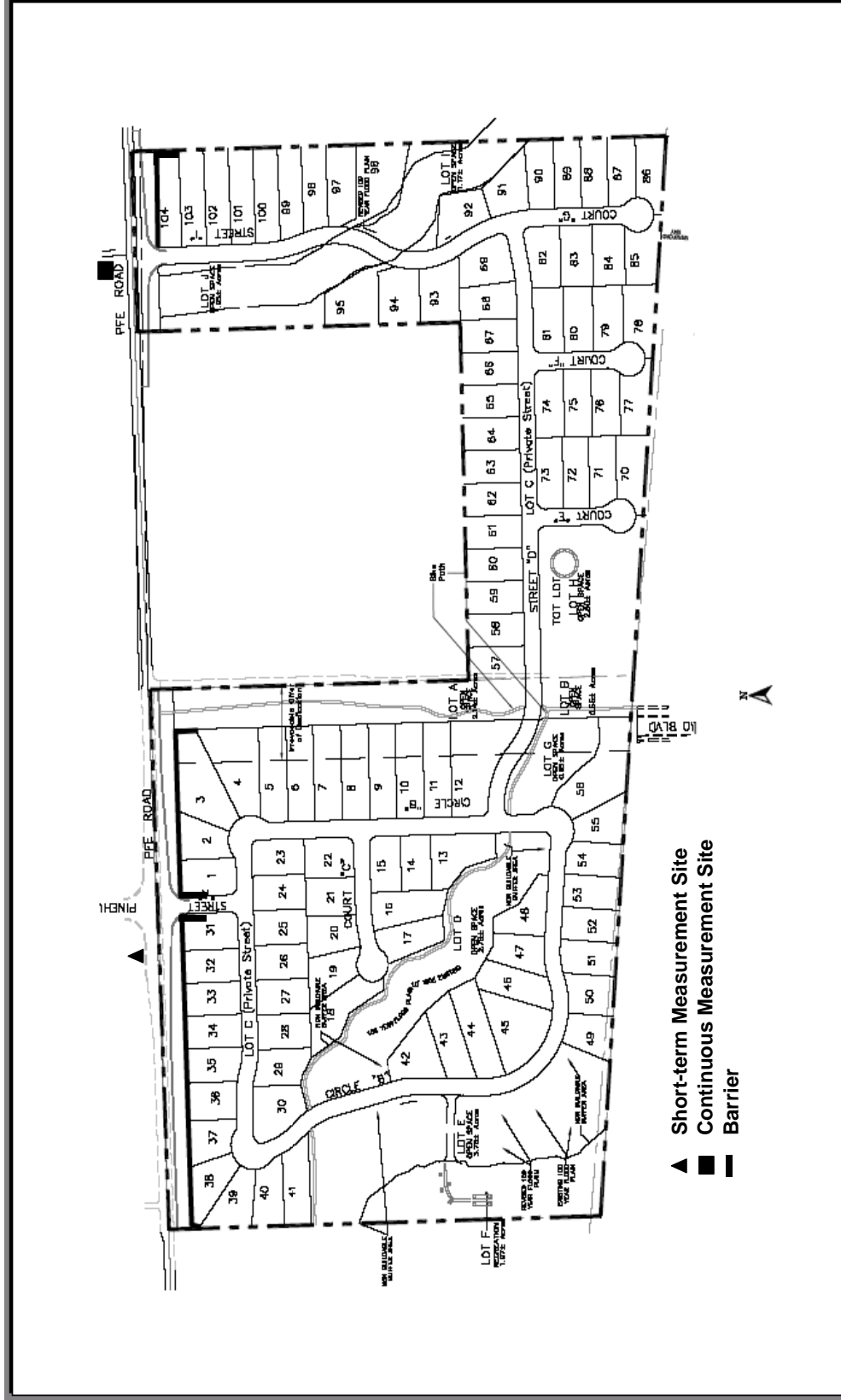
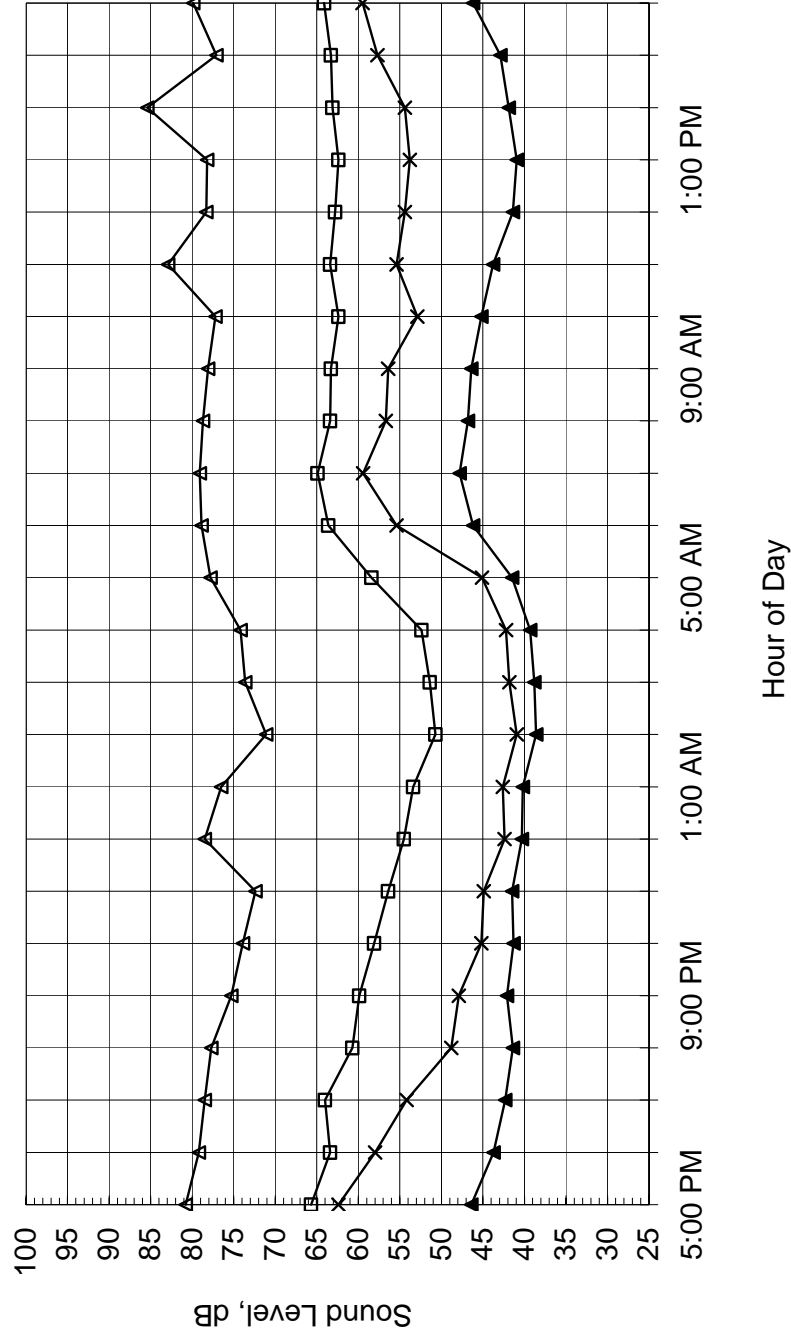


Figure #2: Measured Hourly Noise Levels

9450 Duffy Lane
August 4-5, 2004



Ldn = 65.3 dB

Figure 3

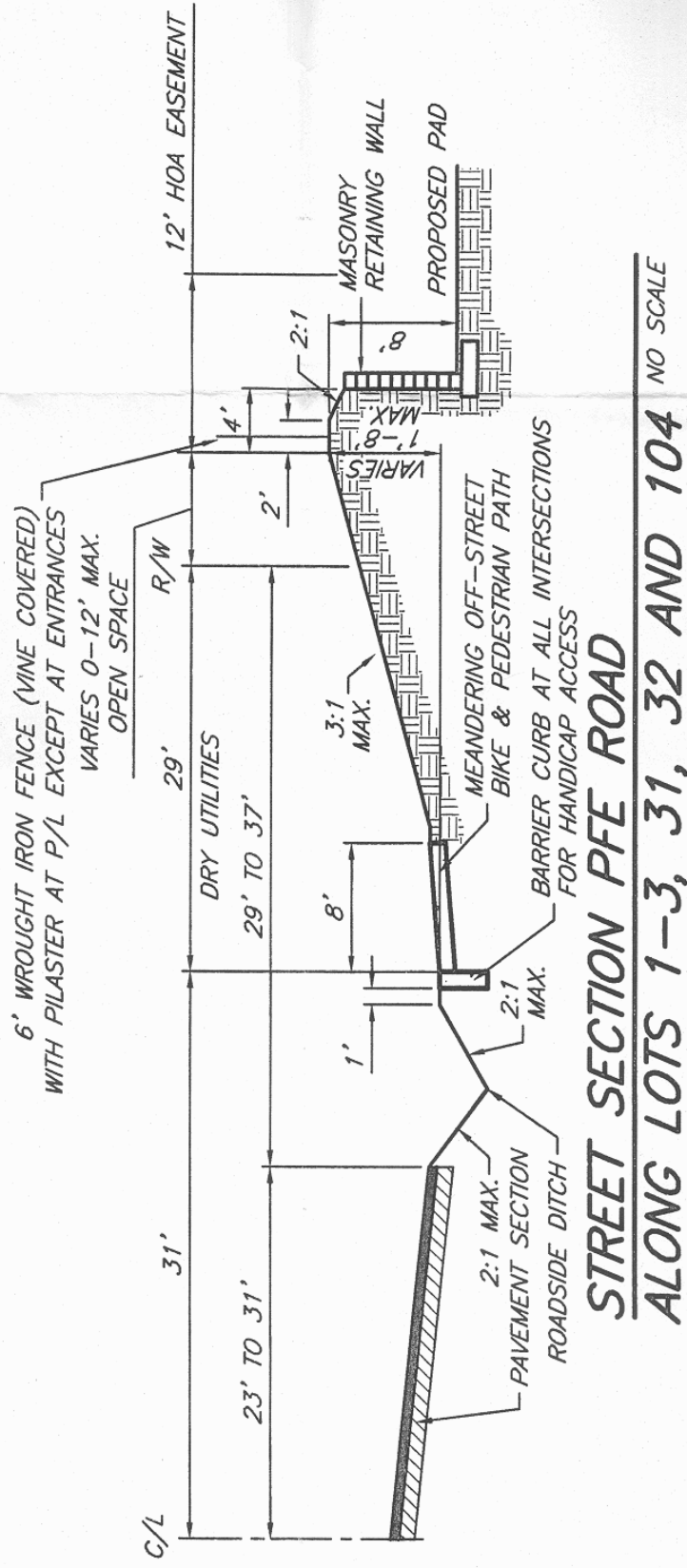
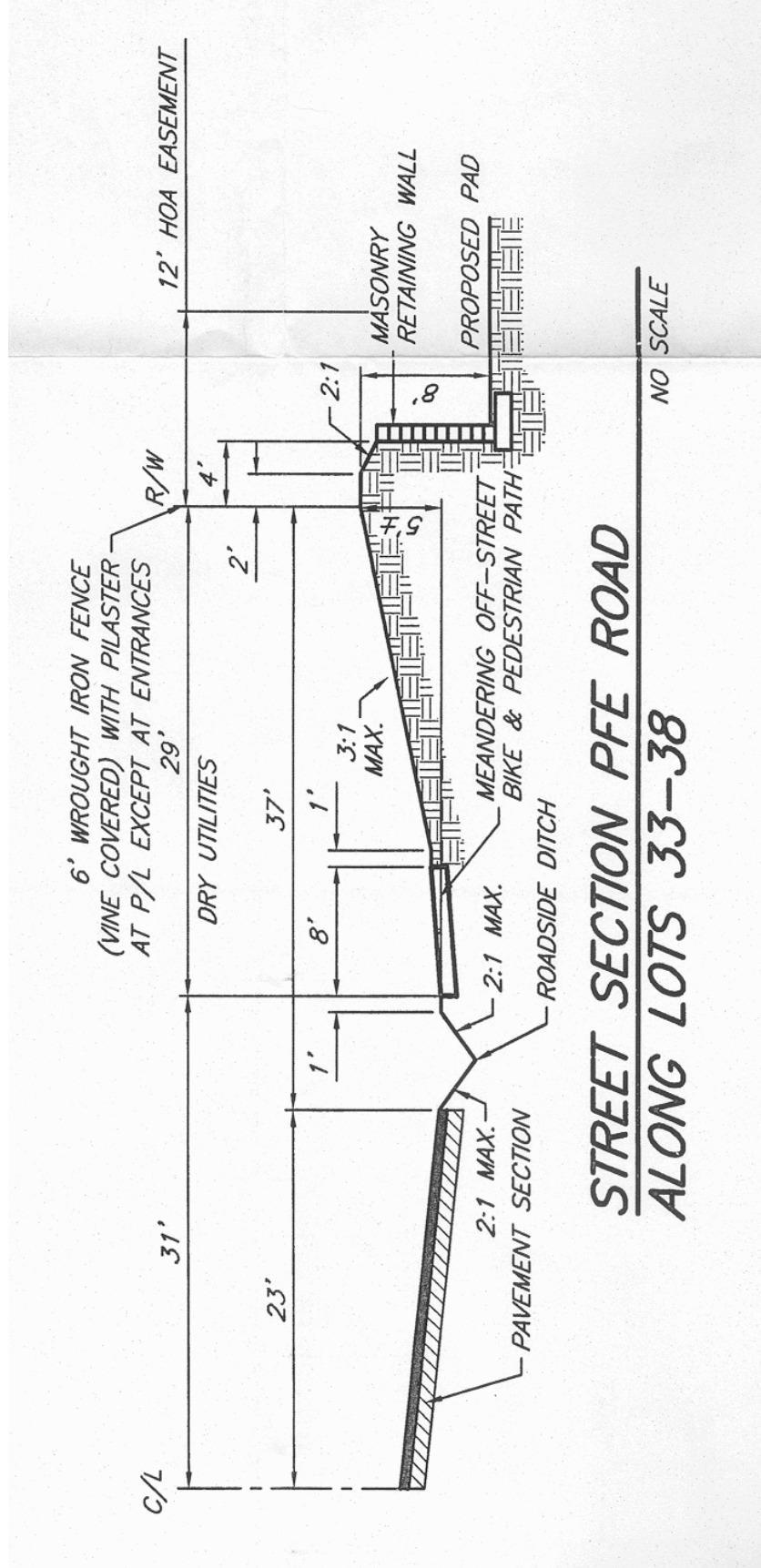


Figure 4



APPENDIX A

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/ L_{dn} : Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq} : Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max} : The maximum noise level recorded during a noise event.

L_n : The sound level exceeded "n" percent of the time during a sample interval (L_{90} , L_{50} , L_{10} , etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS:

Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

NOISE LEVEL REDUCTION (NLR):

The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of “noise level reduction” combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL:

Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL:

The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC):

The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.